

Other aquatic plants, such as *Elaeocharis* spp., *Chara* spp., and *Nitella* spp., were subsequently introduced into the tank. *Etioplus* was found to feed on none of them although the fry were observed to peck and nibble at the tender shoots of *Chara*. Even in the absence of other food the fish was found to avoid these plants.

Control of *Pistia* growth in tanks and ponds is a serious problem in this country. Larvae of at least three species of mansonoid mosquito, viz., *Mansonia* (*Mansonioides*) *annulifera* (Theob.), *M.* (*Mansonioides*) *uniformis* (Theob.) and *M.* (*Mansonioides*) *indiana* (Theob.), the carriers of the dreaded filariasis, are known to live attached to the roots of *Pistia stratiota* Linn. The Health Authorities are at present faced with the grave problem of removing *Pistia* from all the tanks and ponds in certain coastal districts in Central Travancore, where the percentage frequency of filariasis is rather high. To discover whether *Etioplus suratensis* (Bloch) could be of use in checking the growth of *Pistia*, a quantity of these plants were introduced into the *Etioplus* tank in the Aquarium. The fish appeared to be disturbed by the unusual appearance of the hairy roots, even when accustomed to it, avoided the plant as far as possible. Later it was ascertained that in Central Travancore *Etioplus* was common in ponds containing an abundant growth of *Pistia*. It seems that the species shows a marked aversion to some floating vegetation such as *Pistia*, *Lemna* and *Eichhornia*.

Incidentally it may be stated that *Etioplus* is known to take worms and insects and at times it shows a definite predatory tendency. Specimens of *Gambusia affinis* (Baird & Girard) introduced into the aquarium were chased and devoured by them. Whether this was due to carnivorous instincts or to the artificial conditions of life in an aquarium I am not certain. The fact remains that all the *Gambusia* were readily eaten.

MARINE BIOLOGICAL LABORATORY,
UNIVERSITY OF TRAVANCORE,
TRIVANDRUM,
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K. GOPINATH.

XVI.—SOURCES OF FISH SUPPLY TO CALCUTTA MARKETS.

The last year for which statistics of fish imported into Calcutta are available is the year which ended on the 31st March, 1923. In that year approximately 435,194.5 maunds of fish were imported into Calcutta by railways, steamers, country boats and road. It was then stated that 'the most important sources of fish to Calcutta markets are the Padma, the Sundarbans estuaries and the Chilka in Orissa. Very large quantities of *hilsa*, carp and several other species of freshwater fishes come mostly by rail but partly by steamers from the East Bengal'. From Bulletin No. 20 of the late Department of Fisheries, Bengal (Calcutta: 1924), it is clear that the quantity of fish imported into Calcutta was showing a gradual increase for it rose from 308,037.5 maunds in 1918-19 to the figure

for 1922-23 given above, thus registering a net increase in the fish supply of Calcutta by 127,157 maunds in a period of five years. If it be supposed that this rate of increase was maintained then before the advent of the existing abnormal and unsettled conditions, the total supply must have reached one million maunds (1,000,000 mds.). Unfortunately no statistics are available in support of this assumption, but enquiries made in the various Calcutta markets indicate that the fish supply did increase within the last 20 years by about 200 to 300%. Though the methods of capture of fish are still the same, improved methods of preservation and transport made it possible to bring into Calcutta very large quantities of excellent sea fish from the far off deltas at the head of the Bay and the remunerative prices offered in Calcutta attracted fish preserved in ice from several fishing centres as far afield as Assam, Bihar and the U. P.

That the fish supply of Calcutta has increased considerably during the last twenty years is also evident from the fact that whereas in 1923 there was only one wholesale market at Sealdah, there are now several principal fish markets in Calcutta, *viz.*, three markets at Sealdah and one each at Howrah, Ballygunge, Patipukur, Kidderpore, Sir Stuart Hogg's Market, Hathibagan, etc. In order to find out the relative value of the sources of fish supply to Calcutta, one must analyse the statistics available for 1922-23 and compare the data thus collected with the information obtained for 1941-42 through local enquiries.

Comparative statement of fresh fish (in % of total fish supply) imported into Calcutta from different sources :

Year	Salt-water Fish		Fresh-water Fish		
	Sundarban Estuaries	Orissa and Madras coasts, including Chilka Lake	Local, within a radius of 15 to 20 miles	Bengal Districts mostly from the Padma river	Assam, Bihar and U.P.
1922-23	21.80%	7.95%	13.01%	55.52%	1.72%
1941-42	38.00%	3.50%	9.66%	34.34%	14.50%

We may now consider the various sources of supply one by one and see how the Calcutta markets, under the existing emergency condition, have been influenced by them. We may also consider how the supply can be improved from each source so as to relieve the present scarcity of fish.

Sundarban Estuaries:—The Sundarban estuaries have long been recognised to be an inexhaustible store of fish supply for Calcutta, but the main difficulties that stood in the way of increasing the yield from this source were the primitive methods of transport by country boats and absence of any means of preserving fish soon after capture. However, with the advent of motor launches,

especially from 1929 onwards, the estuarine fishery was revolutionised and vast quantities of excellent sea fish, such as Bhekṭi (*Lates & Serranus* spp.), Indian Salmon (*Polynemus* spp.), Rock Salmon (*Otolithus* & allied form), Indian Haddock (*Serranus*), Pomfrets (*Stromateus* spp.), Mulletts (*Mugil* spp.), Hilsa, Bagda, Golda, Chapda and Ghoosa chingris (Prawns and Lobsters), Crabs, (*Scylla serrata*), etc., became available in Calcutta at competitive rates in excellent condition of preservation, for these launches during their outward trip carried ice with them for the preservation of fish. Though in 1940-41, fish from this source formed only 38% of the total supply of Calcutta, in actual maundage, i.e., about 380,000 maunds, this quantity exceeded the total supply of Calcutta during 1918-1919. Though there is always plenty of fish in the Sundarbans, the primitive methods of fishing and frail fishing boats make it more or less a seasonal fishery. The main fishing season starts from October and lasts till February, but from the enclosed salt-water fisheries, known as 'Bhasa Badha', large quantities are exported during the off season also when the fish fetch better prices. The following table shows the variation in the proportion of fish imported into Calcutta from the estuaries month by month.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from the estuaries month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
50	40	37	25	15	20	30	35	45	50	55	55

It will be seen from the above statement that starting from the middle of September and lasting up to the middle of February the fishing season is very brisk in the Sundarbans and imports from this source form more than half of the total supplies imported into Calcutta. During January, February and March, young of Hilsa, under a foot in length, form $\frac{1}{3}$, Bagda chingri $\frac{1}{3}$, Bhekṭi $\frac{1}{6}$ and the other fishes, such as Rock Salmon, Mulletts, Pomfrets, Haddock, etc. the remaining $\frac{1}{6}$ of the total supplies imported into Calcutta markets from this source. In April, the composition of the catches undergoes a considerable change for Hilsa is not available in the estuaries at this season. During April, May and June, the supply comprises $\frac{1}{3}$ Bhekṭi, $\frac{1}{3}$ small prawns and $\frac{1}{3}$ Rock Salmon, Mulletts, Pomfrets, Haddock, etc. all combined. With the establishment of the monsoons, the Hilsa shoals begin to ascend the estuaries and though this migration stops in the middle reaches of the rivers about October, in the Sundarbans adult Hilsa is caught in large quantities from July to September and young Hilsa from October to March. Thus during July to December the fish supply from this source comprises $\frac{1}{3}$ Hilsa, $\frac{1}{3}$ Bagda chingri, $\frac{1}{6}$ Bhekṭi and $\frac{1}{6}$ the remaining varieties of fishes enumerated above.

Mention must also be made of two other important seasonal fisheries in the Sundarbans, i.e., Tengra (*Mystus gulio*) and Sea-Pangas (Ariidae). Shoals of Tengra appear in April-May and their fishery lasts for about three months while the shoals of Sea-Pangas enter the estuaries during August, September and October.

Chilka Lake, Orissa and Madras Coasts:—Though the percentage of salt water fish imported from Orissa and Madras shows a decrease, the actual maundage has increased slightly. In November, December and January somewhat larger supply is received from these areas, otherwise the supply remains constant throughout the year. The chief varieties of fish imported are Hilsa, Bhekhti, Rock Salmon, Mulletts, Haddockts and Prawns, while at certain seasons freshwater fish, such as Carps, are also imported from Orissa. It was in the second decade of the present century that a market in Calcutta for fish from the Chilka Lake began to grow. In 1924, the export of fish, fresh and cured, by rail from this source amounted to 45,000 maunds and by 1937 it had arisen to 71,366 maunds, of which the fresh fish amounted to 60,000 maunds. Though a considerable amount of this supply came to Calcutta, some was distributed to other towns as well.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from the Orissa and Madras Coasts (including the Chilka Lake) month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
5	3	3	3	3	3	3	3	3	3	4	5

This source of supply can be effective only when fast trains are running at times suitable for the fish trade, but at present the timing of the Madras Mail and the slow running of trains are greatly hampering the fish trade between these areas and Calcutta.

Local Supply:—Though the salt-water varieties of fishes that used to be available from local sources during 1922-23 are not now found in the neighbourhood of Calcutta on account of the silting up of the Bidyadhari river and, in consequence, of the absence of salt-water fisheries in the Salt Lakes, Calcutta, the supply of Carp and other varieties of fresh-water fishes has increased considerably. The greater part of the Bidyadhari Spill Area, partly assisted by the Calcutta sewage, is now being used for the cultivation of Carp and considerable quantities of Pona fish are thus available from this source. It will also be noticed that though the percentage of the total fish supply from local sources is now less, the actual maundage is almost double of what it used to be in 1922-23. As is shown in the statement given below, the main supply from the local fisheries is during the dry months of February, March and April and to a certain extent in May, when the shallow fisheries are dewatered and most of the fish, that had been stocked during the rainy season, are removed for sale. However, a certain amount of fish from the areas within a radius of 20 miles of Calcutta is always available in the markets of the town. The great possibilities of meeting the present situation are by developing this source of supply, because it is not effected by any kind of restrictions either on fishing or on transport. With the death of the Bidyadhari and deterioration of the Piali rivers, there are vast sheets of water in the neighbourhood of Calcutta which cannot be drained and are at present unproductive and a regular source of nuisance to public health. These should be stocked for increasing the local supply.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from within a radius of 20 miles month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
5	15	25	32	10	5	4	4	4	4	4	4

Bengal Districts :—The supply of fish to the Calcutta markets from the Bengal districts is considerable but this, during the rainy season, mainly consists of Hilsa from the Padma river and during the other seasons, of Carp, which is extensively cultivated in Bhils and tanks of every part of Bengal. Attention may, however, be directed to the fact that during May, June, July and August, when the supply from the estuaries becomes greatly reduced, the imports of Hilsa from the Padma makes up the deficiency. During October and November, when the waters begin to dry up and it is possible to catch freshwater fishes in large quantities, it is then that we find that the supplies from the Bengal districts are almost equal to one-third of the total import of fishes into the Calcutta markets.

Owing to restrictions on transport by Railways, the supply has also decreased to a certain extent and for this reason Calcutta felt a great shortage of fish during the early part of summer last year. When the swarms of Hilsa came up the river about the middle of August, then the situation was eased to a considerable extent. Much improvement can be effected in this source of supply by the Railways agreeing to grant adequate facilities for the transport of fish.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from the Bengal Districts month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
30	30	20	22	50	50	40	45	35	30	30	30

Assam, Bihar & U.P. :—In the dry months when the waters dry up considerably, large quantities of freshwater fish in inland fishing centres are caught and as better prices always prevail in the Calcutta markets, considerable supplies of fresh fishes, packed in ice, are imported from Assam, Bihar and the U.P. The transport difficulties by Railways, referred to above, had an adverse effect on this source of supply. It is difficult to judge how far this supply can be revived under the existing emergency conditions, but I think the co-operation of the Railway authorities can be very helpful in this connection.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from Assam, Bihar and U.P., month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
10	12	15	18	22	22	23	13	13	13	7	6

The following table shows at a glance the relative value of the various sources of fish supply to the Calcutta Markets and the varieties of fish that are imported from each source:—

Month	Salt-water Fish		Fresh-water Fish			
	Estuaries	Orissa and Madras coast including Chilka Lake	Local supply within a radius of 20 miles	Bengal Districts	Assam, Bihar and U.P.	
Jan. ...	50%	5%	5%	30%	10%	
Feb. ...	40%	3%	15%	39%	12%	
Mar. ...	37%	3%	25%	20%	15%	
April ...	25%	3%	32%	22%	18%	
May ...	15%	3%	10%	50%	22%	
June ...	20%	3%	5%	50%	22%	
July ...	30%	3%	4%	40%	23%	
Aug. ...	35%	3%	4%	45%	13%	
Sept. ...	45%	3%	4%	35%	13%	
Oct. ...	50%	3%	4%	30%	13%	
Nov. ...	55%	4%	4%	30%	7%	
Dec. ...	55%	5%	4%	30%	6%	
For the whole year	38.00%	3.50%	9.66%	34.34%	14.5%	
Varieties of fish available from different sources.	From July to March $\frac{1}{3}$ of the catch is Hilsa, $\frac{1}{3}$ Bagda chingri, $\frac{1}{6}$ Bhekhti, and $\frac{1}{6}$ Rock Salmon, Mulllets, Pomfrets, Haddock, etc. From April to June $\frac{2}{3}$ of the catch is Bhekhti, $\frac{1}{3}$ small prawns, $\frac{1}{3}$ Rock Salmon, Mulllets, Pomfrets, Haddock, etc.		Mostly Hilsa, Bhekhti, Rock Salmon, Indian Salmon, Mulllets, Haddocks and Prawns. Carps in small quantities at certain seasons.	Carps, Jiol fish and Prawns.	From June to October, $\frac{2}{3}$ of the catch is Hilsa and the rest Carps, Jiol fish, etc. November to February $\frac{2}{3}$ of the catch is Carps, $\frac{2}{3}$ Cat fishes and the rest Jiol fish, Prawns, etc. From March to May, $\frac{1}{10}$ of the catch is small Hilsa and the rest Carps, Jiol fish, Prawns, etc.	Mostly Carps; also a very small quantity of Hilsa and Catfishes.

Besides transport difficulties and the unavoidable restrictions on fishing in the Denial Area, attention must also be directed to the fact that due to oil shortage a number of ice factories have not been able to work full time and thus sufficient ice is not available in these days for the proper preservation of fishes. For this reason also the supply imported into Calcutta has sometimes to be curtailed. The number of factors that have brought about the high prices of other, even non-perishable, commodities due to the present emergency conditions have also operated in the case of the fish trade and there are reasons to believe that the fish merchants may have artificially raised the prices to some extent, but there can

hardly be any doubt that the supplies, due to the various reasons cited above, have decreased very materially and result has been the increase in the price of fish in the Calcutta markets and perhaps in other larger mofussil towns also.

Whatever steps it may be possible for the Government to take to increase the fish supply to the Calcutta markets, the fact will remain that the supply, which has never been adequate even in the past, will remain insufficient so long as the present emergency conditions last. The need of the moment is, therefore, that we must definitely concentrate on increasing the local production of fish by stocking all pieces of water and of conserving our existing supplies in such a way as to get the maximum benefit out of them.

1, DEODAR STREET, BALLYGUNGE,
CALCUTTA,
16th December, 1942.

S. L. HORA,
Director of Fisheries,
Bengal.

XVII.—NOTE ON *CURETIS* SPECIES AT KALLAR.

Kallar is at the foot of the Mettupalaiyam Ghat below Coonoor. Its altitude is 1,250 ft. and it is locally abounding in butterflies.

1. *Curetis thetis*, Drury.

This was the only species observed by Hampson in the Nilgiris. He notes, '1,000 ft. to 3,000 ft. S. and W. slopes of the Nilgiris. Very rare. Outer margin of the H. W. much rounded. Both orange and white females are found (?) 'The question mark is mine.

C. thetis is rare at Kallar but I have seen or caught it on the following dates:—♂ 28/3, ♀ 31/7, ♀ 14/8, ♀♀ 22/9. The female is a jungle insect, a characteristic shared to some extent by the females of the other two species. The male does not seem to be attracted much by moisture, and the female will usually be caught settling on the underside of leaves.

2. *Curetis bulis*, Db. and Hew.

3. *Curetis acuta dentata*, Moore.

C. acuta is rare but I have records of it on the following dates:—♂ 31/1, ♂ 28/3, ♂ 16/7, ♀ 7/12, ♂ May, ♀ 20/9 (Ootacamund). All the males were caught settling on damp sand, but the females do not seem to be attracted by moisture.

I also have one definite specimen of *bulis* ♂ taken on 6/12, and another doubtful specimen ♂ caught on 10/5. These also were taken on damp sand. I have no information that *bulis* has been recorded as a South Indian species before, and Evans gives its range as Mussootie—S. Burma. I have come across no females, but the females of both these species seem to be very scarce.